Speculative Design of a Human-AI Interface for Collaborative Football Video Analysis Informed by In Situ Reflective Practices

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Abstract

Stepping into football analysis can be particularly challenging since it requires a clear understanding of player attributes and actions, analytical sensibility, and continuously updated contextual information. Moreover, the typical workflow of football analysts involves the use of different tools to annotate data, capture patterns and connections, and facilitate communication with staff members. Although there are video analysis tools that provide accurate data from competitions around the world, most existing technologies fail to support artificial intelligence (AI)-mediated collaboration in an effective way. In this paper, we present an ongoing project that speculates on possible future interactive scenarios for collaborative football video analysis. The human-AI sociotechnical approach explored in this paper is informed by reflective inquiry and real-world practices of a football analyst working with the Youth National Team and in a top-tier league club in Finland. In our vision, a sociotechnical perspective on AI-assisted football video analysis can scaffold the football analyst's everyday work practices. As a secondary outcome, the elite-level practices identified through the autoethnographic exercise reported in this paper can be translated into affordable digital workflows to make them accessible to lower-budget clubs and facilitate newcomers' first interactions.

Keywords

artificial intelligence, autoethnography, collaboration, computer supported cooperative work, football video analysis, sociotechnical systems, speculative design

1. Introduction

Football is undergoing a profound digital transformation, with artificial intelligence (AI) playing a central role in analytics-supported decision-making and interactive data visualization [1]. As football becomes more complex and data-informed, football analysts now face challenges related to bias and lack of context in algorithmic interpretations, data-driven judgments (e.g.,

The 12th International Conference on Socio-Technical Perspectives in IS (STPIS'26), September 16–17, 2026, L'Aquila, Italy.

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CEUR-WS.org/Vol-4325/paper5.pdf

CEUR Workshop Proceedings ceur-ws.org ISSN 1613-0073

published 2026-11-10

tactical setup), and raw data quality (e.g., poorly recorded video footage) [2]. While substantial research and commercial development have focused on elite football (i.e., major European leagues with dedicated analytics departments) [3], the realities of football analysts in developing or resource-constrained environments remain largely underexplored within information systems (IS) and related design-oriented research communities such as computer supported cooperative work (CSCW), where collaborative experiences with interactive systems are the subject of scrutiny.

In leagues such as the Finnish first tier (Veikkausliiga), the analyst's role is characterized by a high degree of ambiguity and precariousness [21]. Unlike the specialized infrastructures found in leagues such as the Premier League or Bundesliga, analysts in this context often operate in a very individual way, managing a heterogeneous workflow that ranges from using drones during training sessions to performing manual live tagging in constrained and under-equipped indoor and outdoor stadium environments. This setting exemplifies what Star and Strauss [4] describe as "invisible work", which refers to essential activities such as data preprocessing, infrastructure management, and tactical interpretation that remain insufficiently recognized and poorly supported by existing technological solutions.

Many football analysis tools are designed as opaque "black-box" systems or single-user interfaces, offering limited support for AI-mediated collaboration [5-7]. Consequently, there is a need for interactive systems that extend beyond task automation to scaffold situated practices, supporting both the development of analytical expertise among newcomers and the preservation of a club's evolving knowledge base around pre-, in-, and post-match individual and collective attributes and actions. In this paper, we present a research-in-progress study reporting on an ongoing project that uses speculative design to envision futures in which human-AI interaction is proposed to mitigate current gaps in football video analysis. For a systematic mapping of the fundamental characteristics, discursive qualities, and process-related aspects of speculative design as a methodological approach, the reader is referred to [8].

Our work is grounded in a situated inquiry informed by an autoethnographic account of a reflective practitioner working as a video and data analyst for a Finnish top-tier club and a youth national team. Autoethnography is a qualitative research method that has become particularly relevant in the field of IS as it enables researchers to report personal reflections on practices and actions that can inform the design of artifacts [9]. From a CSCW perspective, this method has also been valuable in the in situ development of collaborative technologies. By synthesizing the lived on- and off-pitch experiences of a football analyst in the Finnish context, we envision an interface that supports collaborative sensemaking and knowledge transfer, extending beyond conventional paradigms of football data extraction and analytics.

The contributions of this study are threefold. First, we identify the distinctive challenges of football data work in resource-constrained settings, emphasizing the misalignment between high-performance expectations and infrastructural limitations. A speculative design scenario is then presented to illustrate how AI can function as an "assistant" in scouting. Finally, we derive a set of design requirements for video technology that emphasize temporality, shared situational awareness, interpretation, and the preservation of knowledge bases in football analysis. By framing the analyst's work as a situated sociotechnical practice, we argue that the future of football analysis technology lies not in replacing the human analyst but in designing adaptive interfaces that evolve alongside the fluid and nuanced realities of football practice.

2. How Situated Football Analysis Practices Can Inform the In Situ Design of AI-Mediated Collaborative Technology

Informed by reflective inquiry into the real-world practices of a football analyst working with the Youth National Team and a top-tier league club in Finland, we speculate on possible future interactive scenarios for collaborative football video analysis. In other words, our work uses real-world empirical insights to ground future interactive design concepts. Autoethnography is a well-established methodological approach that enables critical examination of practices in a self-reflective way [10]. In this study, we draw on an autoethnographic diary of an individual informant as a retrospective account of activities conducted over a full season, during which the informant had different analytical roles. These included a position as video analyst for the U15 Boys National Team at the Football Association of Finland (Suomen Palloliitto)[2], where responsibilities involved live match analysis, half-time video editing and clip production, camera and drone-based filming, staff support, individual player video feedback, and live streaming. In addition, the informant worked as an analyst for the Men's First Team at Kuopion Palloseura Oy[3], focusing on recruitment, training, match, and opposition analysis.

Data collection was carried out solely based on the informant's notes. The resulting corpus of field notes was analyzed through repeated readings to develop familiarity with the data, followed by the identification of salient sociotechnical dimensions embedded in the reported practices. In the following, we summarize a set of insights collected from the in situ experiences of the informant. By analyzing these situated practices, we derive design requirements for AI-mediated collaborative technology. Through the lenses of sociotechnical imaginaries [23] and work system theory [24], we discuss a set of requirements that need to be taken into account when developing artifacts for supporting such work practices in "smarter" ways [25] and with end-users in mind [26, 27].

The autoethnographic account reveals that football data work is not a static activity but is performed under significant environmental, physical, and temporal pressures. Reflecting on their role within the youth national team, the informant states that "*the overall objective of the entire operation is to find and develop players for the adult national team, support players' development to international level, advance from qualifiers to age-group final tournaments, and play developmental football together while learning and enjoying*". The analyst's first task before a camp is to participate in a remote meeting where introductions are made, the most important matters regarding the camp are reviewed, and the program is outlined. For the analyst, it is important that the most critical aspects of filming training sessions and matches are covered, including advance information about filming locations and the ordering of equipment needed for the trip, which the analyst does through the national team manager.

Scouting opponents plays a minor role and the analyst usually does not even participate in it since only camp days are paid time. The national team head coaches do most of the football-related preparation for the camp. This includes utilizing previous material in planning the next camp and collecting and preparing materials to be presented in meetings, insofar as old material is used. The analyst hardly participates in deciding on playing style matters or planning the camp's training content. According to the informant, "*it is good for the analyst to ensure that the*

[2] https://www.palloliitto.fi/english
[3] https://kups.fi/

analysis template is up to date and corresponds to the head coach's defined playing style, and that it makes it easy to produce material on the camp's focus areas". If the analyst is working for the first time or if the tools being used have changed, necessary software needs to be installed on devices in good time, and their compatibility and functionality tested. Such tasks are considered "articulation work" in the CSCW literature [11], as they are required to make primary analytical processes possible.

Filming training sessions is one of the analyst's main tasks during camps and tournaments. Either behind one or sometimes both goals are action cameras operated by goalkeeper coaches. These are called back cameras and the material from them is utilized in addition to goalkeeper activities for analyzing actions occurring near the goal such as finishing attempts and preventing them, as well as other box defense-related activity. This material also plays an important role in the analysis of set pieces such as corner kicks and free kicks. Regarding filming performed by the analyst, the main choice is whether to film with a drone or with a video camera mounted on a tripod (side camera), as presented in Figure 1.



Figure 1. Articulation work of a football analyst represented as an idealized workflow sequence that is constantly interrupted by physical, real-time bottlenecks.

If the drone being used is not specifically designed for use in various weather conditions, even light rain may prevent drone filming. On the other hand, current battery technology limits

drones' continuous flight time to approximately 20-30 minutes, which is usually sufficient for filming an individual drill but after this the drone must be landed to change the battery, which takes about a minute during which no video footage is captured. As we further argue in this paper, such limitations could be addressed through a sociotechnical infrastructure that enables football analysts to share video footage and discuss it through a shared interface.

During training sessions and matches, the youth national team analyst also performs tagging on a computer so that the resulting materials can be made available to the coaching staff immediately afterward. Usually, entire drills are broken down into shorter continuous segments (and into highlights when needed), for example when coaching staff request representative examples of specific types of activity or good performances. If material filmed with a camera or drone has not been able to be captured in real time, it is transferred to the computer at this stage using a memory card reader. Then the video material is brought into the tagging software, where it is timed so that tags fall into place. At this stage, there is usually a need to slightly clean up (trim) tag beginnings and endings and to ensure that everything necessary has been tagged correctly.

The data is tagged using the analysis template according to selected themes. Practically, this means that the analyst presses a button on the computer keyboard that creates a category-specific event of predetermined duration on the timeline, as shown in Figure 1. It is possible to have tags for different game phases, principles, and actions. Moreover, there can be buttons that attach qualitative attributes to these events (e.g., to specify the event outcome or other qualitative aspect). Buttons can also be available for special categories such as halftime highlights or coach requests. Some analysts mark laptop keyboard buttons with different-colored tape to make them easier to remember.

Finally, the material is made available to the coaching staff. If everyone uses the same tagging software, sharing the project file or transferring the project to a cloud service may be sufficient. However, materials are often exported as separate video files in a software-independent, general-purpose format. These videos are organized into folder structures to facilitate the retrieval of relevant clips and the material is shared either via a cloud service or through portable drives and USB sticks. Sometimes, sharing data via cloud services may be limited by network connectivity or licensing costs, making portable drives a viable alternative. After this transfer, it is no longer possible to adjust the timing of the clips unless the clips are re-exported. If the project is shared and maintained in its original form, it is possible to adjust the duration of the clips. As a potential direction for addressing current limitations, the envisioned interface could support cloud-based collaborative telestration, allowing analysts to work collectively on annotations while seeing each other's edits in real time.

3. "This Player Has Scored Quite a Few from This Kind of Distance": A Speculative Design Exercise Informed by Real-World Football Analysis Practices

The role of the analyst in professional football has been fundamentally reshaped in recent years [12]. In line with this, football stakeholders worldwide are increasingly adopting AI as a core strategy for generating competitive advantage [13]. As a result, the initial stages of player identification and evaluation have shifted away from in-person match observation toward data-driven and video-based analysis [14]. Although current video analysis tools demonstrate

significant advances in computer vision (e.g., player tracking [15]), they frequently fail to address the concrete sociotechnical specificities involved in long-term tactical development, knowledge sharing, and collaborative sensemaking [21]. In particular, current technical solutions tend to prioritize discrete, event-based metrics such as pass accuracy or long-distance shot frequency but fail to incorporate the collaborative processes that underpin effective football analysis practice.

As highlighted in prior research, the principle of "multiple eyes, multiple times" [16] suggests that the accuracy of football assessments can be enhanced through sustained engagement and collaboration among stakeholders. The authors go even further by claiming that without collaboration, football analysts (i.e., scouts) "will become isolated, which can lead to incorrect judgments and may even result in scouts working competitively against one another, even with scouts who work for the same club, which has the potential to lead to unnecessary conflict". Such interaction remains underrepresented in existing football analysis technologies and may lead to isolated judgments, a lack of accumulated analytical knowledge, and reduced decision-making quality.

Drawing on autoethnographic material from in situ experiences, we discuss how a human-AI interface for football video analysis could address football analysts' collaboration needs through a multi-actor system that extends, rather than replaces, their current workflows. Our goal is to reflect on the possible futures for football analysis and interrogate the sociotechnical implications of AI-mediated collaborative technology. Speculative design [17] is used as a critically oriented approach that relies on leveraging speculative thinking to imagine alternative futures in terms of artifact development. The outcome of the speculative design exercise is discussed in the form of interaction modalities and features that could be incorporated into an intelligent user interface of this kind.

The speculative design exercise is situated within the context of football scouting, a highly nuanced process in which multiple analysts (scouts) share notes and observations about a specific player based on their actions during a match, as perceived through a shared video interface. As a professional practice, scouting involves the systematic observation and evaluation of players to inform strategic decisions. Prior research has examined the characteristics and competencies associated with scouting staff (see e.g. Bergkamp et al.'s [22] work on scouts' judgments in talent identification). In our envisioned scenario, AI plays the role of a scouting "assistant" capable of providing details and insights based on large-scale data processing. Through the use of this envisioned human-centered interface, scouting and performance analysis operate as coordinated, multi-actor processes rather than isolated individual tasks. Evaluation work is distributed across a network of roles such as live scouts, scouting leads, coaching staff, and executive personnel, each bringing domain-specific perspectives to the assessment of players. These users rely on shared data environments and communication structures to exchange insights and build aligned interpretations. In this scenario, football analysis is not an individual judgment but a collectively produced outcome shaped by a shared infrastructure, embedded work practices, and collaborative decision-making. This is achieved through an interface that combines human annotation with automatic visual football training and match analysis features.

The envisioned system should therefore focus on pipeline scaffolding. AI can perform data preprocessing tasks during transit, automatically identifying the boundaries of drills or match phases based on whistle detection or player clustering. AI-mediated systems can also prioritize

multimodal interaction [1]. Moreover, future interfaces could leverage low-latency voice-to-tagging or "gaze-based" event marking, allowing the analyst to annotate tactical patterns without looking away from the camera. AI agents could then "backfill" these voice tags by cross-referencing audio timestamps with computer vision-detected events, merging human intent with algorithmic precision in real time.

Design implications transferred from other speculative design exercises (e.g., [18]) point to the need for using such collaborative approaches as an inclusive solution for technology inequity, tracking overload, inattention, and ineffective knowledge representations that may impact the overall football analysis operations. The integration of AI into football video analysis suggests that systems should prioritize collaboration through human-AI interfaces by enabling analysts to interpret, question, and contextualize algorithmic outputs [21]. To support trust and accountability, interfaces must emphasize transparency and explainability [19, 20], making underlying data sources, model reasoning, and uncertainty visible. Designers should also account for variability in data quality and context by allowing the integration of qualitative insights alongside quantitative metrics. Moreover, considerations of fairness, accessibility, and ethical data governance are essential, requiring tools that mitigate bias, protect sensitive player data, and remain usable across diverse organizational contexts. Overall, effective design should support a human-centered AI-mediated collaborative approach in which data-driven insights enhance (rather than replace) expert judgment.

4. Conclusion and Future Work

In this paper, we discuss implications for designing human-AI interactions in high-uncertainty football analysis domains, highlighting tensions between automation and human expertise. This research-in-progress study uses a situated autoethnographic account to speculate on the future of AI in football video analysis, including a scenario where multiple scouts cooperate toward a common goal. By moving beyond the "black box" of event-based metrics, we have envisioned an interface that supports collaborative sensemaking, preserves collaboration dynamics, and adapts to the collaborative needs of each football analyst. These findings point to opportunities for more robust evaluation in live matches, including further examination of ethical considerations such as potential biases in AI-generated analyses and the governance of the data used to produce them.

Our future work will focus on interviews with football analysts working in different leagues. We are also interested in low-fidelity prototyping of the envisioned features to further bridge the gap between technical feasibility and the lived reality of football data work. By proposing design recommendations for situated and reflective decision support systems in football analytics and beyond, AI-mediated collaborative sensemaking among football analysts can be considered a direction for further investigation and continuously refined designs based on real-world activities and everyday challenges faced by analysts worldwide.

Declaration on Generative AI

The authors have not employed any generative AI tools.

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